System on an SFP™

RAD data communications

Installation and Operation Manual

MiRIC-E1, MiRIC-T1

Miniature Fast Ethernet to E1/T1 Remote Bridge

Version 1.5

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Notice

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RAD warrants to DISTRIBUTOR that the hardware in the MiRIC-E1, MiRIC-T1 to be delivered hereunder shall be free of defects in material and workmanship under normal use and service for a period of twelve (12) months following the date of shipment to DISTRIBUTOR.

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Declaration of Conformity

Manufacturer's Name: RAD Data Communications Ltd.

Manufacturer's Address: 24 Raoul Wallenberg St.
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Israel

declares that the product:

Product Name: MiRIC

Conforms to the following standard(s) or other normative document(s):

EMC:	EN 55022: 1998	Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement.
	EN 55024: 1998	Information technology equipment – Immunity characteristics – Limits and methods of measurement.
Safety:	EN 60950-1: 2001	Information technology equipment – Safety – General requirements.

Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC, the Low Voltage Directive 73/23/EEC and the R&TTE Directive 99/5/EC for wired equipment. The product was tested in a typical configuration.

Tel Aviv, 25 April 2005

Haim Karshen
VP Quality

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Chapter 1
Introduction

1.1 Overview

MiRIC-E1 and MiRIC-T1 are patent-pending remote bridges that forward Fast Ethernet LAN packets to TDM-based WAN at full duplex wire-speed, fully utilizing the expensive E1/T1 rate TDM circuit bandwidth, whether framed or unframed.

MiRIC-E1, MiRIC-T1 have management capabilities for configuration, status, and diagnostics via the SFP I^2C interface.

Housed in a Small Form Factor Pluggable (SFP) package, MiRIC-E1, MiRIC-T1 complies with the Multi-Source Agreement (MSA) for SFPs, MiRIC-E1, MiRIC-T1 also complies with the E1/T1 line and framing requirements.

Product Options

MiRIC-E1

MiRIC-T1

Applications

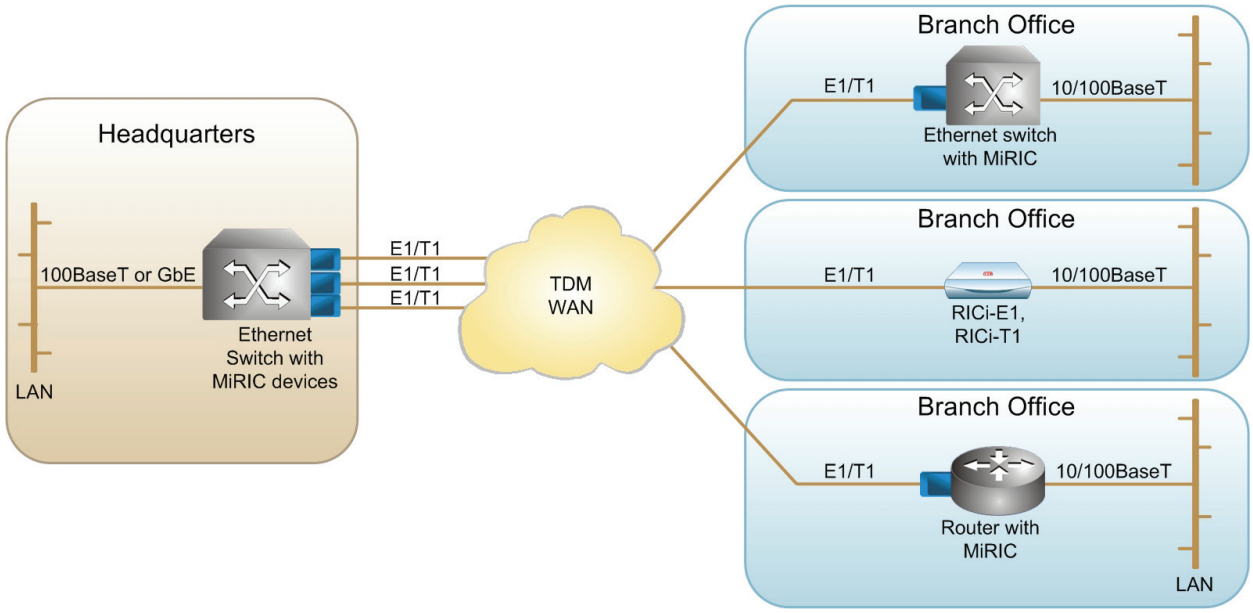

Figure 1-1. Providing Transparent LAN Services over Leased Lines

Features

- Framed or unframed E1 or T1 links
- Basic management for configuration, status and diagnostics.
- Hot-insertion SFP footprint, MSA compliant
- Full duplex wire-speed packet forwarding
- Configurable Tx clock source and data format
  - Internal or Rx clock
  - Framed or Unframed
- Visual fault indication:
  - Loss of E1 or T1 signal
  - Loss of Ethernet link
- Support flow control
- Product identification support
- Easy release mechanism

1.2 Physical Description

MiRIC-E1, MiRIC-T1 are SFP devices that are inserted into a SFP MSA compatible receptacle in a host unit.

Figure 1-2. MiRIC-E1 3D View

Figure 1-3 shows the dimensions.

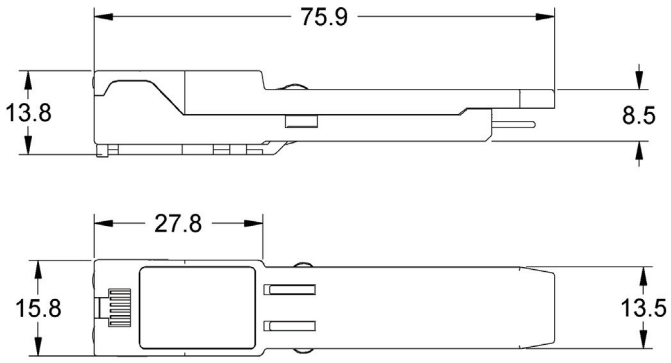

Figure 1-3. MiRIC-E1, MiRIC-T1 Dimensions

1.3 Technical Specifications

E1 WAN INTERFACE

Number of Ports	1
Compliance	G.703, G.704, G.775, G.823
Data Rate	2.048 Mbps
Line Code	HDB3, AMI
Framing	Framed or unframed (switch-selectable and software controllable)
Line Impedance	120Ω, unbalanced
Connector	RJ-45
Cable Length (max)	Short haul – 770m (2530 ft) with 22 AWG cable
	Long haul – 2664m (8740 ft) with 22 AWG cable

T1 WAN INTERFACE

Number of Ports	1
Compliance	G.703, G.775, G.823, T1.403
Data Rate	1.544 Mbps
Line Code	B8ZS, AMI
Framing	Framed or unframed (switch-selectable and software controllable)

Line Impedance	100Ω, unbalanced
Connector	RJ-45
Cable Length (max)	Short haul – 1192m (3910 ft) with 22 AWG cable
	Long haul – 2874m (9430 ft) with 22 AWG cable

LAN INTERFACE

Type	Fast Ethernet SFP port, MSA compliant
Compliance	IEEE 802.3, SFP MSA
Edge Connector	SFP transceiver, MSA compliant

WAN PROTOCOL

Type	HDLC-like framing (native HDLC compatible with RAD products)

GENERAL

LED Indicators	LINK (green) – Ethernet link status
	LOS (red) – E1/T1 loss of signal
Regulatory Compliance	Safety: IEC-60950-1
	EMI: EN55022 (Class B), EN55024, FCC-15
Transmit Clock	Internal or receive (switch-selectable and software controllable)
Power	3.3V, up to 300 mA
Thermal Management	Power dissipation less than 1W
Dimensions	Height: 13.8 mm (0.54 in) Width: 15.8 mm (0.62in) Depth: 75.9 mm (2.99 in) Weight 30.0 g (1.0 oz)

Chapter 2
Installation and Setup

2.1 Introduction

Housed in a Small Form Factor Pluggable (SFP) package, MiRIC-E1 and MiRIC-T1 comply with the Multi-Source Agreement (MSA) and can be inserted into any MSA compatible host unit.

MiRIC-E1, MiRIC-T1 are autonomous plug-and-play hot-insertion modules. The device can be configured manually via DIP switches or via an I^2C Interface. For more details, see *Chapter 4*.

2.2 Site Requirements and Prerequisites

The ambient operating temperature should be –40°C to 70°C (–40°F to 158°F), at a relative humidity of up to 90%, non-condensing.

2.3 Package Contents

The MiRIC-E1, MiRIC-T1 package includes the following items:

- Up to four MiRIC-E1 or MiRIC-T1 units
- Technical documentation CD.

2.4 Configuring MiRIC-E1, MiRIC-T1

MiRIC-E1, MiRIC-T1 framing mode and transmit clock source are configured manually via the DIP switch on the underside of the device.

Note *The DIP switch configuration may be overridden by software commands. The latest configuration is stored in a non-volatile memory, which is retained even if the MiRIC is removed from the host, however, if the DIP switch state is then changed, this overrides the software configuration and the DIP switch setting becomes the latest configuration.*

➤ **To configure the MiRIC-E1, MiRIC-T1**

1. Identify the DIP switch on underside of module (see *Figure 2-1*).

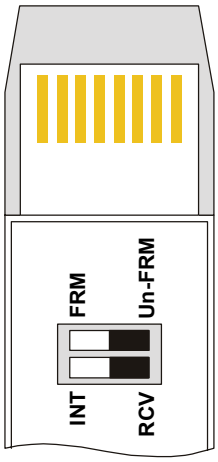

Figure 2-1. DIP Switch Location

2. Set DIP switches according to *Table 2-1*.

Table 2-1. DIP Switch Settings

Switch Identity	Possible Settings	Factory Setting
Framing	FRM – Framed Un-FRM – Unframed	**T1** – Un-FRM **E1** – Un-FRM
Transmit clock	INT – Internal RCV – Receive	 RCV

2.5 Inserting the MiRIC-E1, MiRIC-T1

Note *There is no need to power down the host unit when inserting or extracting the MiRIC-E1, MiRIC-T1.*

➤ **To insert a MiRIC-E1, MiRIC-T1**

1. Insert the MiRIC device into a free SFP (MSA-compatible) socket of the host equipment.
2. Make sure that the MiRIC-E1, MiRIC-T1 is pressed firmly into the MSA SFP port connector.
3. The MiRIC-E1, MiRIC-T1 is ready to operate.

➤ **To remove a MiRIC-E1, MiRIC-T1**

1. Disconnect any cables attached to the MiRIC.
1. Push the release button on the front of the MiRIC-E1, MiRIC-T1. This extracts the device from the edge connector.
2. Remove the MiRIC-E1, MiRIC-T1 from the socket.

2.6 Connecting the Interface Cable

➤ **To connect the interface cable**

- Use a CAT5 cable terminated in an RJ-45 to connect between MiRIC-E1, MiRIC-T1 and the E1/T1 line.

Chapter 3
Operation

3.1 Indicators

The front panel of the MiRIC-E1, MiRIC-T1 has two status LEDs. See *Table 3-1* for details.

Table 3-1. LED Indications

LED	Possible Status
LINK (green)	ON – Ethernet link is valid OFF – No Ethernet link
LOS (red)	ON – No E1/T1 signal is detected OFF – Valid E1/T1 signal is detected

Note *Certain equipment may cause the LINK LED to turn on before the E1/T1 cable has been connected. This is normal.*

3.2 Configuration Alternatives

DIP switch

MiRIC-E1, MiRIC-T1 framing mode and transmit clock source can be configured manually via the DIP switch on the underside of the device, see *Chapter 2*.

Software control via I²C Interface

The MiRIC-E1, MiRIC-T1 has management capabilities including configuration, status monitoring, and diagnostics via the SFP edge connector I²C interface. See *Chapter 4* for the full instruction set and message format.

Chapter 4
API Reference

4.1 Introduction

This section describes MiRIC-E1, MiRIC-T1 management channel, management protocol and management parameters.

The host accesses MiRIC-E1, MiRIC-T1 via the I^2C channel in order to identify the device and perform management.

Two types of messages are described:

- I^2C message – in standard I^2C frame structure
- Management message – the message structure the host sends to the MiRIC-E1, MiRIC-T1 encapsulated in the I^2C message

All address and values in this section are given in hexadecimal.

4.2 SFP MSA Standard

MiRIC-E1, MiRIC-T1 comply with the MSA standard and hence have the same I^2C mechanism. MiRIC-E1, MiRIC-T1 follow the basic parameter map as outlined by the MSA (as based on SFF 8472). *Figure 4-1* describes the mapping of page A0 as seen by the host equipment.

MiRIC-E1, MiRIC-T1 identification parameters reside in page A0.

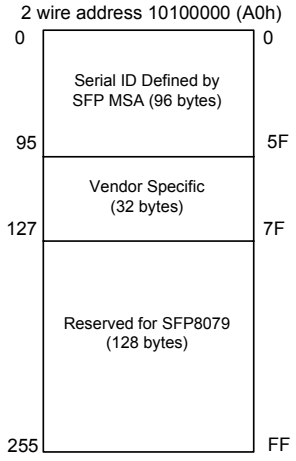

Figure 4-1. Page A0 mapping

As shown above, the second sector, addresses 0x60-0x7F are reserved for vendor specifics. MiRIC-E1, MiRIC-T1 uses these addresses for configuration, diagnostic, and status monitoring parameters.

4.3 Management Message Format

Two types of I²C message structures are transferred from host to MiRIC and vice versa see *Figure 4-2*.

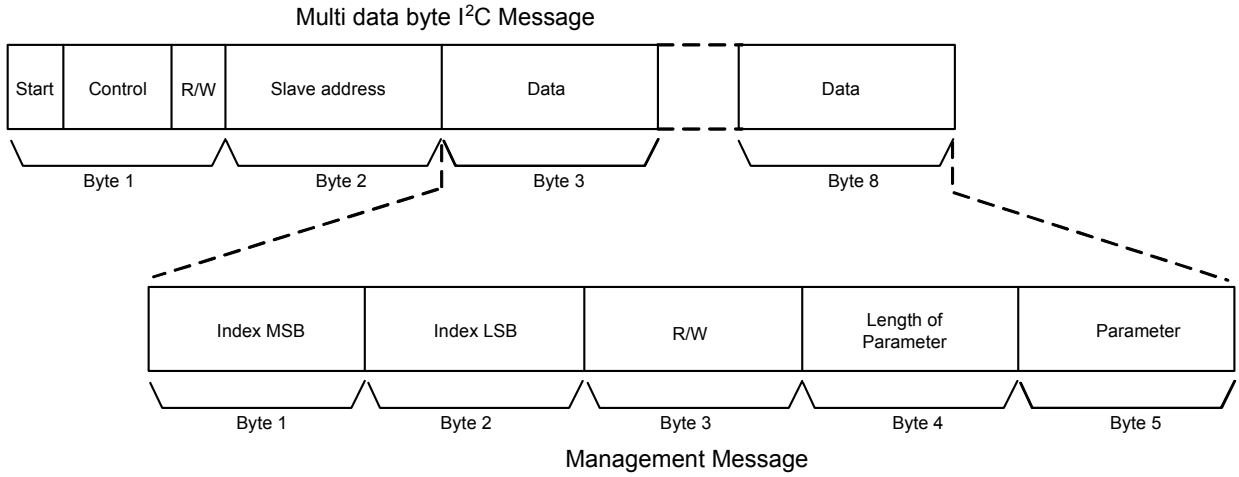

Figure 4-2. Management Message Encapsulated in the Multi-Data byte I²C Message

The management message is encapsulated in the in Data bytes of the I²C message (bytes 3-8). The slave address points to the reserved area in page 0 of the identification memory (addresses 0x60 to 0x7F).

The data bytes of the I²C message carry the message from the host to the MiRIC device.

The host message structure may be a write message such as a configuration message or a read message like status. Messages are sent to the MiRIC in the format shown as described in *Figure 4-3*.

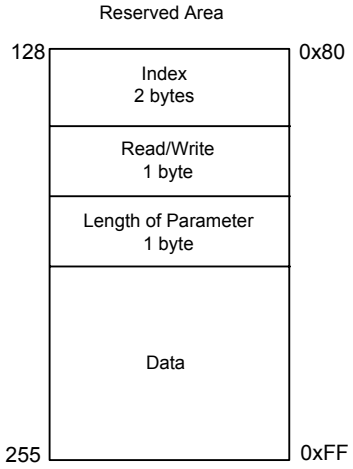

Figure 4-3. Message Format

Index: written into addresses 0x80 and 0x81 – The Index bytes determine the command code of the host message.

Read/Write: written into address 0x82 – This byte determines if the command is a read or write operation.

Length: written into address 0x83 is the number of bytes the parameter comprises. Currently only one byte is allowed.

Parameter: written into address 0x84. The parameter length must be exactly as defined in the Length field. Currently only one byte is allowed.

Once the full message is stored, the MiRIC reads the message and responds with the respective read or write operation.

4.4 Management Procedure

The host is the defined as the master and the MiRIC is the slave, only the host can initiate the management communication procedure.

The host accesses addresses 0x80–0x9E, in the same way that it accesses SFP identification addresses (0x00–0x5F).

I^2C messages from the host are composed from read and write messages. In a read command, the read parameters (Index, R/W, and Length) are stored at addresses 0x80-0x83, following these parameters MiRIC gets the required data byte and stores it in address 0x84. The complete message is then delivered via the I^2C to the host.

Read Message

I^2C encapsulation structure

1. I^2C Control and Write bits in the first byte.
2. Next byte contains 0x80 (as the first address).
3. Next byte with the First byte of the Index (MSB).
4. Next byte with the Second byte of the Index (LSB).
5. Next byte contains 0x01 for a read operation.
6. Byte contains 0x01 for the Length.
7. MiRIC gets the required data byte and stores in address 0x84.

To read the required byte, the host sends a new I2C message with the following structure:

8. I^2C control bits and read bit in the first byte.
9. Next byte contains 0x84 (the address that the parameter is read from).
10. The content of address 0x84 is then delivered to the host equipment.

Note *In event two or more bytes are to be read, two I^2C messages are required, to read addresses 0x84, 0x85 etc.*

Write Message

I^2C encapsulation structure:

1. I^2C control and Write bits in the first byte.
2. Next byte is 0x80 (the first address).
3. Next byte contains the first byte of the Index (MSB) parameter.
4. Next byte contains the second Index byte (LSB) parameter.
5. Next byte is 0x00 for a write code operation.
6. Byte with content of 0x01 for the Length.
7. Byte with parameter data to be written.

4.5 Parameters

General Parameters

The following tasks can be performed:

- Identify if MiRIC is E1 or T1.
- Read the software version X.YZR, where each character in the version number is one byte.
- Reset software.
- Reset to factory defaults.

Table 4-1. General Parameters

Index	R/W	Value	Description
0x1	R	0x01 = MiRIC E1 0x02 = MiRIC T1	E1 or T1
0x2	R	0x00–0xFF	Software version **X**.YZR
0x3	R	0x00–0x63	Software version X.**Y**ZR
0x4	R	All values are in ASCII code A = Alpha 0x41 B = Beta 0x42 D = Development 0x44 E = End of development 0x45 NULL = Official release 0x00	Software version X.Y**Z**R
0x5	R	0x00–0x63	Software version X.YZ**R**
0x12C	W	0x02 – software reset 0x03 – set to factory default	Reset and factory default

Status Parameters

The following status parameters are available for reading:

- Loss of Rx signal (LOS)
- Alarm indication signal (AIS)
- Yellow alarm (T1 only).

Table 4-2. Status Parameters

Index	R/W	Description
0x3E8	R	1= Active 0 = Inactive Digit 0 = LOS (Loss of Rx signal) Digit 1 = Don't care Digit 2 = AIS (Alarm indication signal) Digit 3 = Yellow alarm (T1 only)

Configuration Parameters

Configure the following parameters:

- TLB0 (T1 only), Transmit line build out
- Framed or Unframed
- Line code:
  HDB3 or AMI for E1 and B8ZS or AMI for T1
  AMI
- Clock, Rx clock or internal clock
- Data transmitted or not transmitted on timeslot 16 (E1 only)
- Framing D4 or ESF (T1) or CRC enabled or disabled (E1).

Table 4-3 on the following page describes the configuration parameters.

Table 4-3. Configuration Parameters

Index	R/W	Description	Default
0x514	R + W	Digit 0 – 2, TLB0 (T1 only) - Transmit line build out: 000 = 0 ft – 133 ft 001 = 133 ft – 266 ft 010 = 266 ft – 399 ft 011 = 399 ft – 533 ft 100 = 533 ft – 655 ft 101 = -7 to -5 dB 110 = -15 dB 111 Internal use only	E1: 001 un-configurable T1: 000
		Digit 3, Framed/Unframed: 0 = Unframed 1 = Framed	0 = unframed
		Digit 4, Line code: 0 = HDB3 (E1) or B8ZS (T1) 1 = AMI	E1: 0 = HDB3 T1: 0 = B8ZS
		Digit 5, Tx Clock: 0 = Rx clock 1 = internal clock	0 = Rx clock
		Digit 6, Timeslot 16 (E1 only) 0 = Data transmitted in TS16 1 = No data transmitted in TS16	0 = Data transmitted in TS16
		Digit 7, Framing (T1)/CRC (E1) 0 = D4 (T1)/CRC enable (E1) 1 = ESF (T1)/CRC disable (E1)	E1: 1 = CRC disable T1: 1 = ESF
0x515	R + W	Rx Sensitivity E1 mode Short haul 0 -12 db Long haul 1 -43 db T1 mode Long haul 0 -36 db Limited long haul 1 -15 db	E1 mode Long haul 1 -43 db T1 mode Long haul 0 -36 db
0x518	R + W	Digit 0, Yellow Alarm: 0 = Normal operation 1 = Sends Yellow alarm.	XXXX XXX0 Normal operation
0x531	R + W	Fault propagation 0 = Disable Limited long haul 1 1 = Enable	1 = Enable
0x532	R + W	Tx Disable behavior: 00 = NA – no impact 01 = 3 state 10 = AIS	10 = AIS

Table 4-3. Configuration Parameters (Cont.)

Index	R/W	Description	Default
0x708	R + W	0x5 =TAIS, transmit AIS 0 = Normal operation 1 = Transmits AIS.	Normal operation

Statistic Parameters

The statistics below are updated once a second, it is the host's responsibility to poll the statistics and to calculate the intervals.

Two bytes are reserved for each counter.

Table 4-4. Statistic Parameters

Index	R/W	Parameter	Description	E1/T1
0x640	R	LCVCR 1	Line-Code Violation Count	E1
0x641	R	LCVCR 2		E1
0x642	R	PCVCR 1	Path Code Violation Count	E1
0x643	R	PCVCR 2		E1
0x644	R	FOSCR 1	Frames Out-of-Sync Count	E1
0x645	R	FOSCR 2		E1
0x646	R	EBCR 1	E-Bit Counter	E1
0x647	R	EBCR 2		E1
0x672	R	LCVCR 1	Line-Code Violation Count	T1
0x673	R	LCVCR 2		T1
0x674	R	PCVCR 1	Path Code Violation Count	T1
0x675	R	PCVCR 2		T1
0x676	R	FOSCR 1	Frames Out-of-Sync Count	T1
0x677	R	FOSCR 2		T1

Diagnostic Parameters

The following diagnostics are available:

- Normal operation
- Local loopback, LLB
- Remote loopback, RLB
- Transmit AIS, TAIS.

Table 4-5. Diagnostic Parameters

Index	R/W	Description	Default
0x708	R + W	0x0 = Normal operation 0x1 = LLB 0x2 = RLB 0x5 =TAIS, transmit AIS 1. Normal operation after reset 2. No time out for loops	XXXX X000 Normal operation

4.6 Typical Examples

Reading LCVCR 1 statistic for T1

1. I^2C Control and Write bits in the first byte
2. Next byte with content of 0x80 (as the first address).
3. Next byte with the First byte of the Index (MSB) – **0x06**.
4. Next byte with the Second Index byte of the Index (LSB) – **0x72**.
5. Next byte contains 0x01 for a read operation.
6. Byte with content of 0x01 for the Length (in this example the parameter Length is one byte)

To read the required byte, the host sends a new I2C message with the following structure:

1. I^2C control bits and read bit in the first byte
2. Next byte with content of 0x84 (for the first address).
3. In response, MiRIC sends the contents of address 0x84 (message per byte) to the host equipment.

Configuring LLB

1. I^2C control and Write bits in the first byte
2. Next byte is **0x80** (the first address)
3. Next byte contains the first byte of the Index (MSB) parameter – **0x07**.
4. Next byte contains the second Index byte (LSB) parameter – **0x08**.

5. Next byte is **0x00** for a write code operation.
6. Byte with content of **0x01** for the Length
7. Byte with content of **0x01** sets the LLB parameter

4.7 SFP Identification Fields

Table 4-6. MiRIC-E1/T1 SFP ID fields

Field name	MIRIC-E1	MIRIC-T1
1. Vendor Name	RAD data comm.	RAD data comm.
2. Vendor OUI	0	0
3. Vendor PN	MIRIC-E1	MIRIC-T1
4. Vendor Revision	1.5	1.5
5. Vendor S/N	0	0
6. Identifier	SFP	SFP
7. Ext.Identifier	04	04
8. Connector	Unknown	Unknown
9. Wavelength	0	0
10. Encoding	Unspecified	Unspecified
11. BR Nominal	0	0
12. BR Max	0	0
13. BR Min	0	0
14. Length 9/125 (km)	2	2
15. Length 9/125 (100m)	6	8
16. Length 50/125 (10m)	0	0
17. Length 62.5/125 (10m)	0	0
18. Length Copper (1m)	0	0
19. Year Data Code	0	0
20. Month Data Code	0	0
21. Day Data Code	0	0
22. VS Data Code	0	0
23. Diag Monitor Type	0	0
24. Enhanced Option	0	0
25. SFF 8472 Compliance	0	0
26. CC Base (Hex)	DS	E6
27. CC Ext (Hex)	FF	FF
28.Rate Select	NO	NO

Field name	MIRIC-E1	MIRIC-T1
29. TX Disable	YES	YES
30. TX Fault	NO	NO
31. Signal Loss Inv	NO	NO
32. Signal Loss	YES	YES
33. SONET S1	NO	NO
34. SONET S2	NO	NO
35. OC3 MM Short	NO	NO
36. OC3 SM inter	NO	NO
37. OC3 SM long	NO	NO
38. OC12 MM Short	NO	NO
39. OC12 SM inter	NO	NO
40. OC12 SM long	NO	NO
41. OC48 Short	NO	NO
42. OC48 inter	NO	NO
43. OC48 long	NO	NO
44. 1000BaseSx	NO	NO
45. 1000BaseLx	NO	NO
46. 1000BaseCx	NO	NO
47. 1000BaseT	NO	NO
48. 100BaseFX SM	NO	NO
49. 100BaseFX MM	NO	NO
50. FC Very long	NO	NO
51. FC long	NO	NO
52. FC Short	NO	NO
53. FC Inter	NO	NO
54. FC Media TW	NO	NO
55. FC Media TP	NO	NO
56. FC Media MI	NO	NO
57. FC Media TV	NO	NO
58. FC Media M6	NO	NO
59. FC Media M5	NO	NO
60. FC Media SM	NO	NO

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Customer Response Form

RAD Data Communications would like your help in improving its product documentation. Please complete and return this form by mail or by fax or send us an e-mail with your comments.

Thank you for your assistance!

Manual Name: MiRIC-E1, MiRIC-T1

Publication Number: 412-200-08/06

Please grade the manual according to the following factors:

	Excellent	*Good*	*Fair*	*Poor*	*Very Poor*
Installation instructions	❒	❒	❒	❒	❒
Operating instructions	❒	❒	❒	❒	❒
Manual organization	❒	❒	❒	❒	❒
Illustrations	❒	❒	❒	❒	❒
The manual as a whole	❒	❒	❒	❒	❒

What did you like about the manual?

_____

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Error Report

Type of Error(s) or Problem(s):

- ❒ Incompatibility with product
- ❒ Difficulty in understanding text
- ❒ Regulatory information (Safety, Compliance, Warnings, etc.)
- ❒ Difficulty in finding needed information
- ❒ Missing information
- ❒ Illogical flow of information
- ❒ Style (spelling, grammar, references, etc.)
- ❒ Appearance
- ❒ Other _____

Please list the exact page numbers with the error(s), detail the errors you found (information missing, unclear or inadequately explained, etc.) and attach the page to your fax, if necessary.

_____

_____

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_____

_____

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- ❒ VAR
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Direct telephone number and extension: _____

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